lent work, the result of five years' steady handling and studying of these woods in connection with the timber tests of the forestry division, is at once instructive and suggestive. The plates accompanying this part, camera lucida drawings, are clear and thoroughly illustrative. So far no constant distinguishing microscopic features of the species have been found.

The value of the publication is undoubtedly enhanced to the practical man, as well as to the student, by the introduction written by Mr. Fernow. While in part it is a resumé of the contents of the volume in most compact form, it is original and most useful in that it institutes a comparison of four species (Long-leaf, Cuban, Short-leaf, and Loblolly) in their botanical, geographical, and biological features, and the mechanical properties of their wood. In the latter phase the most exhaustive series of investigations instituted in the timber physics section of the forestry division have been the basis. The results certainly open an entirely new field of study of the most practical bearing, which curiously enough has never before been undertaken so systematically. The curves showing the comparative rate of growth in diameter, height, and volume, placed the Cuban pine in all cases as the most rapid, as well as persistent grower: the Long-leaf as the slowest, yet persistent, while the Loblolly, and still more the Short-leaf, decline somewhere near the 100th year. This is an important point for future forestry, since we are informed that the Cuban pine, protected by its rapid height growth from the start, is gradually displacing the Long-leaf in its own area.

NOTES FOR STUDENTS.

THE EXUDATION of gum from grapevine stems has been carefully investigated by Professor E. Ráthay,[1] of the Royal Institution of Enology and Pomology at Klosternenburg near Vienna. He has gone over the literature and studied the malady from the bacteriological, anatomical, and physiological standpoints, and has arrived at the conclusion that the abnormal action is not brought about by bacteria, as asserted by Prillieux, but is due to wound irritation. This irritation induces the formation of tyloses, resulting in the interruption of the continuity of the protoplasm and the premature death of the cells.— J. C. A.

IN A PAPER entitled "Les Hypostomacées, nouvelle Famille de Champignons parasites," Dr. Vuillemin has given an account[2] of two fungi injurious to conifers in France, one of them, which he names *Meria Laricis*, attacking the living leaves of *Larix Europaea*, but producing its fructification after the latter have died and fallen from their attachment; while the

[1] Ueber das Auftreten von Gummi in der Rebe und über die "Gommose bacillaire." Wien 1896. Pp. 90, with chart.

[2] Bull. d. l. Soc. d. Sciences de Nancy —: 1–55. 1896.

second, described as *Hypostomum Flichianum*, occurs on the leaves of species of Pinus. According to the author, the fructification of both these forms originates below the stomata from a structure, compared by him to the ascogonium of the Ascomycetes, that divides into "fertile cells," giving rise in Meria to filaments which produce externally continuous spores borne laterally on short septate ultimate branchlets or directly from the fertile cells. In Hypostomum, on the other hand, the ascogonium-like organ, which is furnished with a "tube ventilateur" or "trichogyne," gives rise to a sporiferous body so similar to that of a Fusarium that the author proposes the name *Fusarium Flichianum* for the use of such skeptics as may prefer this generic designation to Hypostomum. The plants described are considered to afford a link by means of which the Ustilagineæ, Uredineæ, and Ascomycetes are brought into close association. A considerable portion of the paper is devoted to these comparisons, and although one might be inclined to admit that "L'affinité de ce Champignon (Meria) avec les Ascomycetes est aussi solidement fondée que son affinité avec les Ustilaginées," the general conclusions reached would seem to need further corroboration. The text is accompanied by two plates, which suggest that the forms in question may prove to belong to the "Fungi Imperfecti." In connection with his account of the two species mentioned the author also describes a new species of Hendersonia, *H. montana*, on leaves of *Pinus montana*.—D. R.

THE RECENT CONTRIBUTIONS of H. C. Schellenberg to the knowledge of the structure and function of stomata[3] form an important addition to the literature of that subject. After an historical résumé of the subject and a statement of the varying anatomical conditions, the author first undertakes to demonstrate, in support of Schwendener, that the guard cells effect the closure of stomata independently of the *Nebenzellen*, to whose influence in this movement he assigns very secondary importance. Several cases are cited in which osmotic pressure, the stomata being closed, is greater in the guard cells than in the *Nebenzellen*, and this condition, it is argued, could not obtain if, as Leitgeb asserts, the latter play the chief rôle in the closure movement. Plants deprived of carbon dioxide were found to have closed stomata, when check plants, other conditions being the same, had stomata open, affording further evidence in support of Schwendener that turgor change in guard cells, and control of stomata thereby, is effected by assimilation. Closed stomata, separated from possible influence of *Nebenzellen*, were opened by turgor artificially induced in guard cells, and reclosed upon exposure to darkness. Measurements of the volume changes of the guard cells show them to be $\frac{2}{10}$–$\frac{3}{10}$ larger when stomata are open than when closed. Stomata in all cases observed were found closed at night, evidence

[3] Beiträge zur Kenntniss von Bau und Function der Spaltöffnungen. Bot. Zeit. 54: 169–185. 1896.

directly contradictory to that offered by Leitgeb and afforded by Stahl's *Cobaltprobe*.[4] The cobalt chloride test for the condition of stomata the author regards as not affording such absolute evidence of stomatic conditions as his own microscopic observation, cuticular transpiration confounding the results obtained by the former means. Finally it is stated that all observations made by the author point toward a return to the conclusions of Schwendener, that the guard cells as independent organs effect the opening and closure of stomata by means of the variations in their osmotic pressure, induced in turn by variation in the activity of assimilation working under the influence of light; and hence stomata are controlled by assimilation, being open in light and closed in darkness, and influencing transpiration *through physical necessity*. Against the conclusion of Leitgeb, that these structures are organs of transpiration rather than assimilation, it is urged that change in illumination is shown to be a much more powerful factor in effecting the stomatic movements than changes in water supply; that evidence of the closure of stomata before apparent wilting is insufficient to prove the case; that stomata closed in darkness cannot be opened by increase of moisture in the atmosphere nor by artificially induced root pressure; and, finally, that stomata are, more than anything else, open when assimilation is most active and closed when darkness diminishes this activity and hence induces flaccidity of chlorophyll-containing guard cells.—J. G. C.

M. E. D'HUBERT has written an interesting paper[5] upon the embryo sac of fleshy plants. After devoting considerable space to an historical résumé of the physiological and morphological problems of reproduction, he gives a detailed account of the ovules of the Cactaceæ, Mesembrianthemaceæ, and Crassulaceæ. In the Cactaceæ the funiculus contains starch, bnt none is found in the nucleus. Starch appears in the embryo sac at the time of the first division of the nucleus, and increases in quantity as the sac develops. Just before fertilization the synergids, oosphere, and polar nuclei are richly supplied with starch, but the antipodals have lost much of their starch and seem to be degenerating. Fertilization takes place about three weeks after pollination. During this period the antipodals disappear completely, and the synergids lose some of their starch, but the nutrition of the sac proceeds actively, and a great quantity of starch accumulates around the polar nuclei, which are very late in fusing. When the pollen tube reaches the sac, the nucleus of one synergid advances to meet the nucleus of the tube, while the nucleus of the other synergid moves toward the nucleus of the oosphere. The polar nuclei now fuse, and the resulting nucleus

[4] Einige Versuche über Transpiration und Assimilation. Bot. Zeit. **52**: 117–146. 1894.

[5] Recherches sur le Sac embryonnaire des Plantes grasses. Ann. Sci. Na Bot. VIII. **2**; 137–28, *plate 1–3*. 1895.

almost immediately divides, so that there are four or five nuclei in the endosperm when the fusion of sex-cells takes place. As the endosperm develops the starch disappears. The pollen tube contains starch as it passes through the style, but not at the time of fertilization. The author claims that the state of the reserves forms a basis for determining the functions of the various cells of the embryo sac, and concludes that the antipodals nourish the sac before fertilization, the synergids give nutrition to the nucleus of the pollen tube and the nucleus of the oospore at the time of its formation, and the polar nuclei nourish the egg and give rise to the endosperm.

The ovules of the Mesembrianthemaceæ and Crassulaceæ showed the same starch reserve. Many other forms were studied, both in monocotyls and dicotyls, and the author's conclusion is that all fleshy plants have starch in the embryo sac. Some non-fleshy plants exhibit in a feeble degree this character, which is general for fleshy plants. The author thinks that there is some connection between the starch reserve and the slowness of the phenomena which precede fertilization.—C. J. C.

MR. D. T. MACDOUGAL[6] has been investigating the relation of the growth of foliage leaves and the chlorophyll function. The main purpose of the investigations was to determine the extent to which leaves are dependent upon food supplies constructed within their own tissues, and to what extent development may proceed at the expense of food stored in neighboring or organically connected members. The species used in his work were *Arisæma triphyllum*, *Calla palustris*, *Hibiscus Rosa-sinensis*, *Isopyrum biternatum*, *Justicia* sp., *Lilium tigrinum*, *Oxalis floribunda*, *O vespertilionis*, *Phœnix dactylifera*, *Trillium erectum*, *T. erythrocarpum*, and *Zea Mays*. In general, they were all studied as to the effect of an atmosphere free from CO_2, and the effect of darkness. It was made evident that the leaves of different species exhibit individual reactions to an atmosphere free from CO_2. The author divides the existence of a leaf into three periods, viz., (1) from the rudimentary condition to the unfolding of the lamina, (2) the unfolding and expansion of the lamina to such an extent as to attain a normal stature, and (3) the existence of the organ after maturity has been reached. During the first period the leaves develop without regard to the amount of CO_2 in the air. During the second period the greatest amount of divergence occurs, the leaves of some plants perishing quickly in an atmosphere free from CO_2, others developing more or less completely before perishing, others attaining a size less than normal and then continuing to lead a healthy life, and others developing in a normal way. The behavior of leaves in an atmosphere free from CO_2 and in darkness exhibits the greatest divergences. Thus, leaves of Mimosa and Phaseolus may attain normal size in darkness but quickly perish in air free from CO_2, while in Isopyrum and Oxalis exactly the reverse

[6] Jour. Linn. Soc. 31: 526–546. 1896.

is true. The following conclusions are also sustained: (1) material constructed in active chlorophyll areas and stored in special organs may be transported to inactive chlorophyll bearing organs in some plants in light and in darkness, and used in such manner as to allow of the perfect development of these organs; (2) the removal of concurrent members in darkness may have no effect, may cause an exaggerated development of the petioles, or may result in the perfect development of the entire leaf; (3) it is possible for some plants to form perfect leaves in darkness, some when a portion of the stem only is darkened, and others when the entire plant is etiolated, thus showing that no invariable connection exists between the phototonic condition and leaf development; (4) the conclusion of Jost, that pathological conditions ensue more quickly in inactive leaves in light than in darkness, is not capable of general application; (5) placing a leaf under such conditions that it cannot construct food material sets in motion the specific regulatory mechanism of the organism in such a manner that the plastic material may be withdrawn and the organ cast off; (6) it is to be noted that plants may not be classified upon the basis of species entirely as to their reaction to an atmosphere free from CO_2, since a given plant may be capable of developing inactive leaves at one stage of its development, and not at another.— J. M. C.

THE GASES produced by certain bacteria when grown in 2 per cent. sugar bouillon have been studied by L. H. Pammel and Emma Pammel,[7] of the Iowa Agricultural College, using Theobald Smith's fermentation tube. Five species were fully studied, of which a micrococcus from cheddar cheese gave no gas. The production of hydrogen and carbon dioxide from the other species was as follows:

Species	Source	Glucose		Saccharose		Lactose	
		% H	% CO_2	% H	% CO_2	% H	% CO_2
Bacillus aromaticus	Rotting cabbage	73.6	26.36	77.2	22.6	0	0
B. gasoformans	Imperfectly sterilized gelatin	77.25	19.65	56.45	43.5	0	0
B. mesentericus vulgatus	Imperfectly sterilized potato	0	0	37.05	63.4	76.5	25.4
B. coli communis	.....	75.8	24.18	60.9	32.9	71.95	28.0

Morphologic and ecologic data are also recorded.— J. C. A.

[7] Centralblatt für Bak. u. Par. II, 2: 633–650, *pl.* 5. 1896.

MR. JOHN KLERCKER has published a very interesting paper[8] upon the polymorphism of some lower forms of algæ, speaking chiefly of *Stichococcus subtilis* and *S. bacillaris*. These forms are found to exist either as isolated cells or as filaments. Great variation is shown in both species as to the dimensions of the cells, size of the chloroplasts, and behavior of the forms in different culture media. The old taxonomy called the unicellular forms *Stichococcuss ubtilis* and *S. bacillaris*, while the filamentous forms were known as *Ulothrix subtilis* and *U. flaccida*, respectively. These seem to be nothing more than different phases of the same thing, if it be conceded that the filamentous forms of Stichococcus warrant their association with Ulothrix filaments. The author states that no starch grains are formed in *S. subtilis*.—O. W. C.

IN HIS RECENT revision[9] of the genus *Silene* Mr. Frederic N. Williams recognizes nine genera in the subtribe Silenoideæ, viz., Agrostemma, Lychnis, Coronaria, Petrocoptis, Heliosperma, and Melandryum, with one-celled capsules; and Viscaria, Eudianthe, and Silene, with capsule plurilocular at base. This treatment refers many North American species to Melandryum which have been described under Silene, as *S. Bernardina*, *Lemmonii*, *montana*, *occidentalis*, *Oregana*, *Palmeri*, *Parishii*, *platyota*, *plicata*, *Shockleyi*, *Thurberi*, all of Watson, *S. Drummondi* Hook., *S. longistylis* Engelm., *S. simulans* Greene, and *S. subciliata* Robinson. Thus restricted, 390 species of Silene are recognized, but twenty-five of which are natives of North America. The author is to be congratulated that in the revision of so large and perplexing a genus he has found it necessary to describe but five new species. The synonymy of three North American species may be noted. *S. verecunda* Watson is *S. Behrii* Williams; *S. incompta* Gray (*S. multicaulis* Durand) is *S. Bridgesii* Rohrb.; *S. Scouleri* Hook. contains *S. Drummondii* Gray, *S. Hallii* Watson, and *S. purpurata* Greene.—J. M. C.

AT A RECENT MEETING of the German Academy of Science and Arts at Frankfort, Professor O. Drude presented a contribution on the taxonomy of Umbelliferæ, which is briefly and somewhat unsatisfactorily reported.[10] As he is known to have had this difficult group in hand for several years for presentation in Engler and Prantl's *Natürlichen Pflanzenfamilien* no small degree of interest is felt in reference to his conclusions. The report from which this statement is made is rather indefinite, but probably indicates the larger outlines with sufficient clearness. The family is thought to present three great divisions, Hydrocotylinæ, Saniculinæ, and Apioinæ. The first division is characterized by the absence of oil tubes and the formation of

[8] Flora **82**: 90–106, *pl.* 6. 1896.
[9] Jour. Linn. Soc. **32**: 1–196. 1896.
[10] Bot. Central. **68**: 211. 1896.

a hard fruit, the woody endocarp containing an abundance of crystal bearing cells. Coriander, belonging to the third group, also has a woody endocarp but lacks the crystal bearing cells. The Saniculinæ do not possess a characteristic fruit, and the oil tubes are either wanting or they replace the fibrovascular bundles. The Apioinæ constitute the large and very perplexing group of the family, and are broken up into eight tribes. The intricate relationships of these eight tribes are presented, the Scandicineæ apparently being related to the Saniculinæ through Echinophora and Arctopus. The Scandicineæ in turn are represented as having three lines of relationship connecting them with all the other tribes of Apioinæ. One of these lines leads to the Ammineæ, which in turn are connected through the Seseleæ and Peucedanum with the Peucedaneæ. Another line connects Scandicineæ with Daucineæ, through Caucalineæ, and Daucineæ in turn are connected with Thapsieæ. The third line connects Scandicineæ with Smyrnieæ, which in turn lead to Coriandræ. It should be said that these statements are derived from a complex schematic presentation without any explanatory text, and that so far as numbers and type indicate the eight tribes of Apioinæ are Echinophora, Scandicineæ, Coriandræ, Smyrnieæ, Ammineæ, Peucedaneæ, Thapsieæ, and Daucineæ, although the inconsistent terminology does not indicate correlative groups.— J. M. C.

AN IMPORTANT CONTRIBUTION to our knowledge of the affinities and development of the Phalleæ, as illustrated by the successive stages of *Mutinus caninus*, is based upon Professor Burt's study[11] of an essentially complete series of the eggs of this species (the smallest of which measured not more than $\frac{1}{5} \times \frac{2}{5}^{mm}$), including conditions not hitherto critically examined by students of the group, and furnishing evidence of crucial importance in connection with the consideration of phylogenetic relationships between the Phalleæ and the Clathreæ. The structure and development of the form in question were studied by means of microtome sections, excellent figures of which accompany the text, and seem to afford important data in support of the author's view, recently more fully elaborated in his paper on *Clathrus columnatus*, according to which the Phalleæ are regarded not as an offshoot from the Clathreæ, but as constituting an independent and parallel series not directly related to them.—R. T.

J. G. AGARDH, in the third fascicle of his very important *Analecta Algologica*,[12] describes the following species which are new to science and to the American flora: 1. *Phylittis tenuissima*, Florida (*Curtiss*); 2. *Endarachne Binghamiæ* (a new genus near Scytosiphon), California (*Bingham*); 3. *Cystoseira Myrica occidentalis* (*C. Myrica* Palm. Ag. Baham. no. 8), Florida and

[11] Annals of Botany **10**: 343. 1896.

[12] Acta Soc. Reg. physiograph. Lundensis **7**: —. 1896.

the Bermuda islands; 4. *Hooperia Baileyana* (Harv.), a genus established upon the *Chylocladia Baileyana* described by Harvey in his *Nereis Boreali Americana* 185, *pl. 80;* 5. *Diplocystis Browneæ* (*Callophyllis Browneæ* J. Ag. Bidr. Alg. Syst. 4 : 36), West Indies (*Curtiss*); 6. *Liagora opposita*, Florida; 7. *L. tenuis*, Florida; 8. *L. corymbosa*, Florida and the Bermuda islands; 9. *L. paniculata*, West Indies (*Curtiss*). On account of the homonymous genus Diplocystis proposed by Berkeley and Curtiss (*Cuban Fungi* 344; *cf.* De Toni in Saccardo Syll. Fung. 7[1] : 92), it is necessary to change the name given by Agardh and to use **Agardhinula** mihi.—De Toni.

Items of taxonic interest are as follows: In the continuation of his work upon *Potentilla* Rydberg describes[13] three new species, *P. ramulosa* from Arizona, *P. bicrenata* from Colorado and New Mexico, and *P. millefolia* from California. Davenport has given a full account,[14] with Faxon's illustrations, of his new *Aspidium simulatum*, published in this journal.[15] Mr. Henry Ridley has published[16] an account of the Orchidaceæ, Apostaciaceæ, and Cyrtandraceæ of the Malay peninsula. Eighty-seven genera of orchids are represented, fifteen of which are confined to the Malay peninsula and archipelago, and four of which are described as new, Staurochilus, Renantherella, Pelatantheria, Ascochilus. The genus Dendrobium is the largest, being represented by seventy-eight species. No less than 130 new species of orchids are described, and about thirty-five new species of Cyrtandraceæ. Mr. R. Allen Rolfe has published[17] a revision of the genus Vanilla. It is widely diffused throughout the forest region of the tropics, but the species are very local. Fifty species are known, and of these twenty-nine are American, eleven Asiatic, and ten African. The greatest display of the genus is in Brazil and Guiana. H. Christ has described[18] numerous new species of ferns from Costa Rica. Professor E. L. Greene has issued another fascicle[19] of new species belonging to the following genera: Crepis (4 spp.), Allocarya (3 spp.), Oreocarya (9 spp.). M. C. De Candolle has published[20] an enumeration of the Begoniaceæ of Costa Rica, the genus Begonia containing twenty species, five of which are described as new. Dr. F. W. Klatt has published[21] a second fascicle of the Compositæ of Costa Rica, the first being published in the same

[13] Bull. Torr. Bot. Club, **23** : 429. 1896.

[14] Garden and Forest **9** : 484. 1896.

[15] Bot. Gaz. **19** : 495. 1894.

[16] Jour. Linn. Soc. **32** : 213–416, 497–528. 1896.

[17] Jour. Linn. Soc. **32** : 439–478. 1896.

[18] Bulletin l'Herb. Boiss. **4** : 657–663. 1896. Bull. Soc. Roy. Bot. Belg. **35** : 167–249. 1896.

[19] Pittonia **3** : 107–114. 1896.

[20] Bull. Soc. Roy. Bot. Belg. **35** : 256–267. 1896.

[21] Bull. Soc. Roy. Bot. Belg. **35** : 277–296. 1896.

journal in 1892. The present contribution adds thirteen new species. A recent contribution[22] from the Gray Herbarium by Dr. B. L. Robinson and Mr. J. M. Greenman contains the following subjects: a revision of the genus Tridax, containing twenty-two species, three of which are new; a synopsis of the Mexican and Central American species of the genus Mikania, containing thirteen species; a revision of the genus Zinnia, containing sixteen species, two of which are new; a revision of the Mexican and Central American species of the genus Calea, containing twenty-eight species, five of which are new; a provisional key to the species of Porophyllum north of the Isthmus of Panama, containing twenty-six species, three of which are new; descriptions of new and little known phanerogams, chiefly from Oaxaca, the new species belonging to the genera Habenaria, Spiranthes, Cranichis, Microstylis (2 spp.), Phoradendron, Euphorbia (3 spp.), Cardiospermum, Erythræa, Nama (2 spp.), Berendtia, Castilleia, Carlowrightia (2 spp.), Oldenlandia, Eupatorium (2 spp.), Chrysopsis, Bigelowia, Lagascea, Trigonospermum, Montanoa (2 spp.), Viguiera, Verbesina (4 spp.), Dahlia, Flaveria, Liabum, Senecio, Gochnatia, Perezia (2 spp.). The current bulletin[23] from the natural history departments of the University of Iowa contains the following botanical papers: the puff balls of eastern Iowa, by T. H. MacBride and Norra Allin; new species of tropical fungi, by Ellis and Everhart, fourteen in number, and chiefly from Nicaragua; and the Nicaraguan myxomycetes, by T. H. MacBride and C. L. Smith. The current parts (140 and 141) of Engler and Prantl's *Natürlichen Pflanzenfamilien* contain the continuation of Labiatæ, by J. Briquet, in which Calamintha is merged under Satureia, and Pycnanthemum becomes Koellia; and the completion of the Fucaceæ, by F. R. Kjellman, and the beginning of Rhodophyceæ, by Fr. Schmitz and P. Hauptfleisch.—J. M. C.

HANSGIRG recognizes[24] four types of flowers whose protection of their pollen against rain belongs to the realm of phytodynamics. (1) Plants whose flowers close in rainy weather, so that the entrance of rain drops is rendered difficult or impossible, while the flowers or capitula, seated upon a rigid stalk not capable of rain-avoiding curvatures, do not change their position. (2) Plants whose flowers at anthesis upon flexible erect straight pedicels have their opening zenithward, but at the approach of rainy weather, without closing the perianth, protect their pollen, nectar, etc., against wetting by special rain-avoiding curvatures of their pedicels. (3) Plants whose inflorescences seek to protect themselves against rain by special curvatures of the axis of inflorescence or of the axis carrying the capitula, umbels, etc., especially of

[22] Proc. Amer. Acad. 32: 1–51. 1896.

[23] Bull. Lab. Nat. Hist. Univ. Iowa 4: 1–96. 1896.

[24] Uebersicht der vier Typen von regenscheuen Blüten, deren Pollenschutz, etc., auf phytodynamischen Principe beruht, (Esterr. bot. Zeits. 46: 357. O. 1896.

the terminal part where the flowers are in anthesis. (4) Plants whose flowers, erect and open in fine weather, upon the approach of rainy weather not only close the perianth, but also turn the flower away from the source of the rain drops by curvatures of the pedicels or axes.— C. R. B.

THE USTILAGINEÆ of Kansas have been listed and their germination in part studied by Mr. J. B. S. Norton.[25] Thirty-three species are given, of which two are described as new, viz., *Ustilago filifera* on Bouteloua racemosa and B. oligostachya, and *U. minor* on B. hirsuta. The previously known species on B. oligostachya (*U. Boutelouæ* Kell. and Swing.) was studied and compared with the new kinds. The germination of nineteen species was attempted, and with success in the case of fourteen. The characteristic results of the germination are shown upon five plates.— J. C. A.

IN A RECENT paper[26] Professor L. F. Ward treats of some analogies in the lower Cretaceous of Europe and America. Among the various subjects considered, the occurrence of ancestral forms of angiosperms in the Jurassic and lower Cretaceous, and the distribution of fossil cycad forests are of special interest to botanists. In America fine collections of lower Cretaceous cycadean trunks have been found in the Black Hills of South Dakota, in beds probably belonging to the Kootanie, and in the Potomac formation of Maryland. During his recent visit in Europe, Professor Ward found a collection of twenty-one cycadean trunks, which had been obtained from the Purbeck beds of the Isle of Portland, where the specimens described by Buckland in 1828 were obtained. These specimens, which have been purchased by the United States National Museum, are small and dwarfish when compared with the American forms from Maryland and the Black Hills. A fossil cycad trunk has also been found in the Scaly clays of the Province of Bologna, Italy. The Scaly clays are undoubtedly lower Cretaceous, and it is probable that all the numerous cycad trunks found in Italy were derived originally from these Scaly clays. From a consideration of these facts, it seems that cycads of the tuberous stem type were of very wide distribution in the temperate zone during lower Cretaceous times.

Before 1888 no dicotyledonous plants had been known from any deposits older than the Cenomanian, with the single exception of Heer's *Populus primæva* from the Kome beds (Urgonian) of Greenland. It was supposed, therefore, that the present dominant vegetation had its origin in the middle Cretaceous. Fontaine, while working on the fossil plants of the Potomac formation, found that the great majority were ferns, cycads, and conifers; yet there were certain obscure forms, represented by broad expansions resembling fronds or leaves, with coarse reticulate nervation, which he was

[25] Trans. St. Louis Acad. Science **7**: 229–241. *pl. 25–29*. 1896.

[26] Ann. Report U. S. Geol. Surv. **16**: 463–540. 1896.

unable to refer to these groups. He thought they might represent peculiar dicotyledonous leaves. At the same time that Fontaine was working at the Potomac flora, Saporta was studying the lower Cretaceous of Portugal. He found some true dicotyledons, but other forms he established under a special division which he named proangiosperms. One of the important genera referable to this group is Protorhipis of Andrae, founded in 1853 upon a remarkable form from the Lias of Hungary. This specimen was named *P. Buchii*, and was considered to be a fern. In the meantime other species were described: *P. asarifolia* Zigno, from the Oolite of Italy; *P. integrifolia* Nath., and *P. crenata* Nath., from the Rhetic of Sweden; *P. reniformis* Heer, from the Oolite of Siberia; *P. cordata* Heer, from the Urgonian of Greenland; and *P. Choffati* Sap., from the Urgonian of Portugal. Saporta has reviewed all of these species and concludes that they do not belong to the ferns, but are truly archetypal angiosperms. Four other genera, Changarniera, Yuccites, Delgadopsis, and Eolirion, are put in the group proangiosperms. These last four genera are considered to be ancestral monocotyledons. Saporta, however, hesitates to class *Protorhipis Buchii*, *P. integrifolia* and *P. crenata* with his proangiosperms, since they lack the distinction of midrib and secondary nerves, although they closely resemble certain dicotyledonous leaves and are comparable in nervation with Credneria and some fossil viburnums. Certain Potomac forms referred by Fontaine to Menispermites, Hederæphyllum, Proteæphyllum, and Populophyllum, have some resemblance to *Protorhipis Choffati* through their areolate nervation, and no doubt represent ancestral types of angiosperms.

Thus the true angiosperms have been traced far below the middle Cretaceous, the Jurassic of Portugal alone containing eight monocotyledons and one proangiosperm; and if the forms classed as proangiosperms are truly the forerunners of both the monocotyledons and dicotyledons, as Saporta considers them, we have an apparent fern origin for the angiosperms.—J. H. S.

DR. HERBERT M. RICHARDS, of Barnard College, has published[27] an account of the development of aecidia upon several hosts, Peltandra, Houstonia, Ranunculus, Anemone, and Sambucus. The work was undertaken with the purpose of determining with greater definiteness the origin of the basidia and the structure and development of the peridium. It seems that the basidia arise from certain hyphae, called fertile hyphae, situated in the midst of the primordium or pseudo-parenchymatous mass of mycelium, which indicates the beginnings of an aecidium. The fertile hyphae are simply modified vegetative hyphae, somewhat larger and richer in granular protoplasm than their neighbors. They may be somewhat twisted, suggest-

[27] On some points in the development of aecidia. Proc. Amer. Acad. 31: 255. 1896.

ing the appearance of a Woronin's hypha, but nothing was discovered that could be directly homologized with an archicarp.

The basidia bud out from the fertile hyphae, and new basidia are formed mainly at the periphery, but some younger ones may later be intercalated between the old. Sometimes the fertile hyphae branch to a considerable extent (aecidium on Ranunculus), and it is probable that there is present more than one fertile hypha in large aecidia. The fertile hyphae in the aecidia on Peltandra and Houstonia branch very little. Spores are formed after the manner described by Rosen. The sterile interstitial cell is cut off from the lower portion of the spore mother cell. In many cases the spores contain a triple nucleus in place of the usual double nucleus. The peridium appears to result from the metamorphosis of the outer layer of spores or spore mother cells. In the aecidium on Sambucus there are even present at first the interstitial cells, but these soon disappear with the enlarging of the peridial cells and the thickening of their walls.—B. M. D.

MINOR NOTICES.

THE INDIANA ACADEMY of Sciences has been a strong and active society from its organization in 1885. In March 1895 the state assumed the expense of the publication of its proceedings, three volumes having previously been printed by the society. The proceedings for 1894 and 1895 have been printed in accordance with the state law, and put into the hands of the state librarian, who has only recently distributed them for lack of funds to cover postage. The volume for 1895 contains 298 pages and many well printed illustrations. Its articles embrace a wide range of subjects and are of high merit. The principal botanical papers are as follows: Wm. Stuart describes experiments which reduced the smut of corn from 13 per cent. to 3 per cent. by using Bordeaux mixture, and to 6 per cent. by using ammoniacal copper carbonate; Severance Burrage gives a new station (Lafayette, Ind.) for *Pleodorina Californica*, with notes upon some features of its occurrence; Stanley Coulter reports upon noteworthy Indiana phanerogams and upon some special collections as part of the state biological survey, which has been under way for three years; Alida Cunningham also contributes to the survey an account of the distribution in the state of thirty-seven species of Orchidaceæ. There are shorter articles or notes upon the circulation of protoplasm in Chara by D. W. Dennis, microscopic changes in the shrinkage of woods by M. J. Golden, microscopic slides as adjuncts to an herbarium by John S. Wright, and forms of *Xanthium Canadense* and *X. strumarium* by J. C. Arthur. There is an extended report upon a biological survey of Turkey lake, from which one misses an account of the aquatic or plankton flora, with the exception of a note on the occurrence of a Rivularia in quantity to form *Wasserblüthe*, and of a Palmella that replaces it in a similar way in late autumn.—J. C. A.